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Transit Temperatures and Quality of CANTALOUPS

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Effect of Load Size and Icing Service on Rail Shipments

Marketing Research Report No. 554

U.S. DEPARTMENT OF AGRICULTURE
Agricultural Marketing Service
Market Quality Research Division

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Brooks Cumming Co., Los Banos, Calif.
Coit Ranch, Inc., Mendota, Calif.
Pacific Farm Co., Firebaugh, Calif.
Pappas and Co., Mendota, Calif.
Sam Hamburg Produce Co., Los Banos, Calif.
Sunset Packing Co., Los Banos, Calif.

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Washington, D. C. July 1962

TRANSIT TEMPERATURES AND QUALITY OF CANTALOUPS

Effect of Load Size and Icing Service on Rail Shipments

By J. K. Stewart and M. J. Ceponis [1]
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SUMMARY

Transit temperatures in heavy (432 or 416 crates) and light (324 crates) loads of melons were essentially the same when cantaloups were shipped under the same icing service.

Transit temperatures and market quality of cantaloups did not differ appreciably in cars shipped under the conventional Standard Refrigeration Service with full-bunker icing and those shipped under the less expensive half-stage Standard Refrigeration Service or a full-bunker modified service using two re-icings in transit.

These were the principal findings from 12 paired-car rail shipments of melons from California to east coast markets during 1958, 1960, and 1961. The average trip temperature of cantaloups for all cars shipped under the modified refrigeration service (rule 254) and under the half-stage Standard Refrigeration Service (rules 201 and 255) was 40° F. The average trip temperature for all cars shipped under the conventional full-bunker Standard Refrigeration Service (rule 201) was 39°.

Using the heavy rather than the light load saves about 11.5 percent in freight charges. Using the less expensive refrigeration services rather than the conventional refrigeration service would save from $19.77 to $36.50 per car.

BACKGROUND

Shipments of cantaloups from western producing areas to eastern markets have been affected by two major changes in transit conditions--load sizes have been increased and transit times have been reduced. Rail tests with the new schedules and loads were conducted from 1958 to 1961 to determine (1) if the conventional refrigeration service was adequate for the heavier loads, and (2) if refrigeration services less expensive than the conventional service would provide adequate refrigeration for the faster schedules. These tests were part of a broad program of research aimed at maintaining quality of farm products during marketing.

Ryall and Radspinner[2] conducted shipping tests with cantaloups in 1952 and found Standard Refrigeration with half-stage icing to be satisfactory for melons shipped to New York. Half-stage Standard Refrigeration was included in the current study because of the changes in load size and rail schedules since 1952. A full-bunker modified refrigeration service also was compared to the more expensive, conventional Standard Refrigeration Service with full-bunker icing.

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[1] Mr. Stewart is a horticulturist at Fresno, Calif., and Mr. Ceponis is a plant pathologist at New York, N. Y.
[2] Ryall, A. L., and Radspinner, W. A. Half-Stage Icing of Cantaloupes Tests Successful. Western Grower & Shipper. 24(5): 54-59. 1953.

METHODS

Test cars were shipped in pairs from the San Joaquin Valley, Calif., to the New York market to compare different load sizes and refrigeration services (Car M was diverted to Philadelphia, Pa.). The cars in any one test were loaded and shipped on the same day, from the same shed, and in most tests, by the same route to the same destination (table 1). All cars were precooled in the conventional manner with top ice and fans.

TABLE 1.--Loading data, refrigeration services, routings, and trip temperatures of test cars of cantaloups, shipped from the San Joaquin Valley, Calif., to the New York market, 1958, 1960, and 1961

Factor studied, test number, California shipping point, shipping date, and car	Size of load	Refrigeration		Routing[2]	Average trip temperature
		Rule	Services[1]		
LOAD SIZE:	Crates				°F.
Test 1, Mendota, 8/18/58:					
Car A	432	201 and 202	Pre-iced, full-bunker, Standard Refrigeration, 2% salt 1st and 2d re-icing.	SP, UP, AT&SF, TPW, PENN	40
Car B	324	...do...	.....do	.....do	39
Test 2, Los Banos, 8/25/58:					
Car C	432	201	Pre-iced, full-bunker, Standard Refrigeration, no salt.	SP, UP, WAB, ERIE, NYS&W	38
Car D	324	...do...	.....do	.....do	38
Test 3, Mendota, 9/9/58:					
Car E	416	...do...	Pre-iced, full-bunker, Standard Refrigeration, no salt.	SP, UP, MOP, NYC&ST.L, LV, NYNH&H	38
Car F	324	...do...	.....do	...do	38
REFRIGERATION SERVICE:					
Test 4, Mendota, 8/22/60:					
Car G	384	201 and 255	Pre-iced, half-stage, Standard Refrigeration, no salt.	SP, UP, CB&Q, ERIE	38
Car H	384	201	Pre-iced, full-bunker, Standard Refrigeration, no salt.	.....do	38
Test 5, Mendota, 8/31/60:					
Car I	384	201 and 255	Pre-iced, half-stage, Standard Refrigeration, no salt.	SP, UP, C&NW, ERIE	39
Car J	384	201	Pre-iced, full-bunker, Standard Refrigeration, no salt.	.....do	38
Test 6, Mendota, 8/10/61:					
Car K	384	201 and 255	Pre-iced, half-stage, Standard Refrigeration, no salt.	SP, UP, CB&Q, ERIE, NYNH&H	42
Car L	384	201	Pre-iced, full-bunker, Standard Refrigeration, no salt.	.....do	39
Test 7, Mendota, 8/24/61:					
Car M	384	201 and 255	Pre-iced, half-stage, Standard Refrigeration, no salt.	SP, UP, CB&Q, PENN	42
Car N	384	201	Pre-iced, full-bunker, Standard Refrigeration, no salt.	SP, UP, CB&Q, EL, NYNH&H	39
Test 8, Mendota, 8/22/61:					
Car O	384	201 and 255	Pre-iced, half-stage, Standard Refrigeration, no salt.	SP, UP, CB&Q, ERIE	45
Car P	384	201	Pre-iced, full-bunker, Standard Refrigeration, no salt.	.....do	43
Test 9, Mendota, 8/2/60:					
Car Q	416	254b	Pre-iced, full-bunker, replenished, 2 re-icings in transit (Ogden, Utah, Kansas City, Mo.) no salt.	SP, UP, AT&SF, TPW, NYC&ST.L, ERIE, NYS&W	36
Car R	416	201 and 202	Pre-iced, full-bunker, Standard Refrigeration, 2% salt, 1st and 2d re-icing.	SP, UP, CB&Q, NYC	35

See footnotes at end of table.

TABLE 1.--Loading data, refrigeration services, routings, and trip temperatures of test cars of cantaloups, shipped from the San Joaquin Valley, Calif,, to the New York market, 1958, 1960, and 1961--Continued

Factor studied, test number, California shipping point, shipping date, and car	Size of load	Refrigeration		Routing[2]	Average trip temperature
		Rule	Services[1]		
REFRIGERATION SERVICE--Continued	Crates				°F.
Test 10, Los Banos, 8/17/60:					
Car S.....	416	254b	Pre-iced, full-bunker, replenished, 2 re-icings in transit (Ogden, Utah, Kansas City, Mo.), no salt.	SP, UP, AT&SF, TPW, PENN	38
Car T.....	416	201 and 202	Pre-iced, full-bunker, Standard Refrigeration 2% salt 1st and 2d re-icing.	.....do.....	38
Test 11, Firebaugh, 7/26/61:					
Car U.....	448	254b	Pre-iced, full-bunker, replenished, 2 re-icings in transit (Ogden, Utah, Peoria, Ill.), no salt.	SP, UP, AT&SF, TPW, PENN, NYNH&H	43
Car V.....	448	201 and 202	Pre-iced, full-bunker, Standard Refrigeration, 2% salt 1st and 2d re-icing.	.....do.....	40
Test 12, Los Banos, 8/1/61:					
Car W.....	416	254b	Pre-iced, full-bunker, replenished, 2 re-icings in transit (Ogden, Utah, Chicago, Ill.), no salt.	SP, UP, CB&Q, NYC-&ST.L, LV, LI	43
Car X.....	416	201	Pre-iced, full-bunker, Standard Refrigeration, no salt.	.....do.....	41

[1] See page 6 for description of Standard Refrigeration.
[2] Rail lines abbreviated in accordance with the Official Railway Guide, National Railway Publication Co., New York.

Transit temperatures were measured with recording thermometers placed in test crates of cantaloups in the bottom, middle, and top layers of the load at the quarter-length position in each of the cars. Trip temperatures were computed by averaging the temperatures at 12-hour intervals starting with midnight of the day of loading.

Temperatures in heavy loads (432 or 416 crates) and light loads (324 crates) of melons were compared during August and September 1958. In both types of loads the crates were placed crosswise, four wide; in the light load the crates were three layers high and in the heavy load they were four layers high. The cars used in comparing transit temperatures of different load sizes were shipped under full-bunker Standard Refrigeration.

In the 1960 tests comparing the different refrigeration services, melons were examined on arrival in New York and after being held 2, 4, and 6 days at 70° F. General appearance, firmness, suture browning, decay, and surface mold were determined. The examinations were made at the U.S. Department of Agriculture's Market Pathology Laboratory in New York, N. Y. Melons from the 1961 tests were observed at time of arrival, but were not held for subsequent examinations.

Test melons were size 36 and were either "hard ripe" or "eastern choice" maturity at shipping point. Eastern-choice melons are full-slip,[3] mostly yellow, and firm; hard-ripe melons are three-quarters to full slip, with little yellow color, and usually hard in texture. Melons of the same maturity were used in both cars of a given test, and melons of both maturities were used in cars shipped under each of the refrigeration services tested.

[3] "Slip" refers to separation of the melon from the stem along an abscission layer. A full-slip melon leaves a clean break, while melons of less than full-slip maturity leave varying percentages of torn stem tissue at the stem scar.

The refrigeration services compared during 1960 and 1961 were Standard Refrigeration with full-bunker icing (rule 201), Standard Refrigeration with half-stage icing (rules 201 and 255), and a modified refrigeration service with full-bunker icing (rule 254).[4] All test cars were pre-iced. Cars shipped under Standard Refrigeration are re-iced to capacity at every regular re-icing station. Cars shipped under rule 254 are pre-iced, replenished at the first regular re-icing station, and re-iced one, two, or three times in transit.[5] The number of re-icings and the re-icing stations are specified by the shipper. In this report 254a means one re-icing in transit and 254b means two re-icings. Icing records for the cars used in comparing refrigeration services are given in table 2.

TABLE 2.--Icing records for test cars of cantaloups shipped from California to the New York market, 1960 and 1961

Test number, car, and refrigeration rule[1]	Bunker ice									
	Pre-ice	Added in transit								Total
		1st day	2d day	3d day	4th day	5th day	6th day	7th day	8th day	
	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
Test 4:										
Car G, rules 201 and 255....	6,000	3,900	1,200	--	2,600	2,000	2,000	--	--	17,700
Car H, rule 201.....	11,500	5,000	2,000	--	3,000	1,800	2,200	--	--	25,500
Test 5:										
Car I, rules 201 and 255[2]...	6,000	2,900	1,800	--	4,300	2,800	5,000	--	--	25,200
Car J, rule 201.....	11,500	4,000	2,800	--	3,500	3,000	3,600	--	--	28,400
Test 6:										
Car K, rules 201 and 255....	6,000	4,800	3,500	--	4,200	3,000	3,400	--	--	24,900
Car L, rule 201.....	11,500	6,000	1,800	--	3,600	2,800	2,600	--	--	28,300
Test 7:										
Car M, rules 201 and 255....	5,800	4,600	3,200	--	5,400	4,800	4,500	--	--	28,300
Car N, rule 201.....	11,500	6,000	6,000	--	4,700	4,200	3,000	--	--	35,400
Test 8:										
Car O, rules 201 and 255....	5,800	2,500	--	5,800	--	4,800	4,400	3,800	--	27,100
Car P, rule 201.....	10,000	4,600	--	7,800	--	5,500	4,800	3,600	--	36,300
Test 9:										
Car Q, rule 254b.....	11,500	[3] 2,800	1,200	--	5,100	--	--	--	--	20,600
Car R, rules 201 and 202....	11,500	2,400	2,200	--	5,500	3,600	3,400	--	--	28,600
Test 10:										
Car S, rule 254b.....	11,500	6,000	3,300	--	4,500	--	--	--	--	25,300
Car T, rules 201 and 202....	11,500	4,500	3,800	--	3,900	2,400	3,400	--	--	29,500
Test 11:										
Car U, rule 254b.....	11,500	6,000	4,000	--	--	6,600	--	--	--	28,100
Car V, rules 201 and 202....	11,500	4,400	2,000	--	5,100	2,100	2,000	1,600	2,100	30,800
Test 12:										
Car W, rule 254b.....	10,000	3,200	1,800	--	--	7,500	--	--	--	22,500
Car X, rule 201.....	10,000	2,500	1,800	--	--	5,500	3,000	--	--	22,800

[1] See table 1 for test car refrigeration services, etc.
[2] 2,400 pounds of ice added to bunkers at time of precooling.
[3] First re-icing in transit called "replenish" for cars shipped under rule 254b.

[4] The refrigeration service rules used in this report are from Perishable Protective Tariff No. 18.
[5] Re-icing at the first regular re-icing station is called "replenish" by Tariff No. 18 and is implied under rule 254.

RESULTS

Effect of Load Size on Transit Temperatures

Cantaloup temperatures differed slightly in the heavy and light loads during the first 1 or 2 days in transit, but were about equal during the remainder of the transit period (fig. 1). The differences during the early portion of the transit period were due largely to variations in initial melon temperatures. In test 1 the heavy load was warmer than the light load initially and also during the early part of the transit period, whereas in test 2 the light load was warmer than the heavy load initially and also during the first day in transit. Temperatures in the heavy and light loads in test 3 were almost identical for the entire transit period.

The average trip temperatures of the melons in the heavy and the light loads in test 1 differed by only 1 degree; the average trip temperature of the melons in the four cars in tests 2 and 3 was the same (38° F.). Load size, therefore, had little effect on transit temperatures of cantaloups shipped under Standard Refrigeration with full-bunker icing.

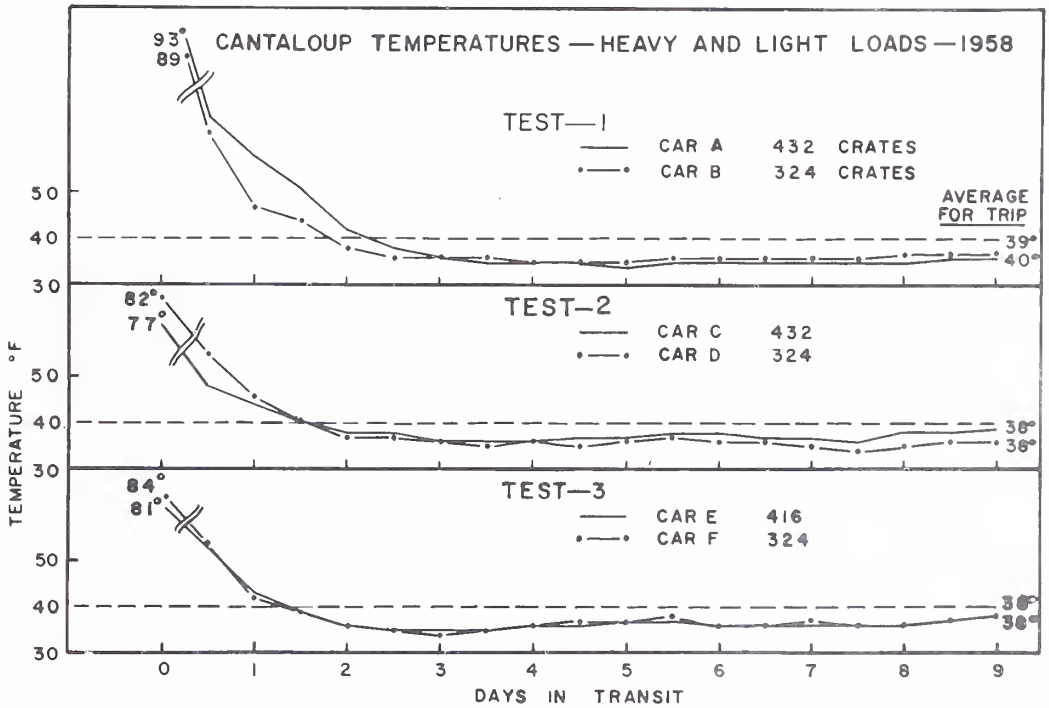

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Figure 1. --Transit temperatures of heavy and light loads of cantaloups shipped under Standard Refrigeration with full-bunker icing from California to New York, 1958. (Average temperatures of top, middle, and bottom layers).

Effect of Refrigeration Service on Transit Temperatures

Half-Stage vs. Full-Bunker Icing. --Five pairs of cars were used for comparing Standard Refrigeration under half-stage icing and under full-bunker icing. The interval of re-icing and the time in transit was about the same in four pairs of these cars (tests 4, 5, 6, and 7), so their transit temperatures and icing data have been averaged (figs. 2 and 3). Sufficient ice was maintained in the bunkers by the frequency of re-icing to provide satisfactory transit temperatures in the half-stage cars. Temperatures in the half-stage cars averaged 40° F. for the trips, and those in the full-bunker cars averaged 39° (fig. 2). With either icing service, the top layer was the coolest in transit, averaging 1 to 2

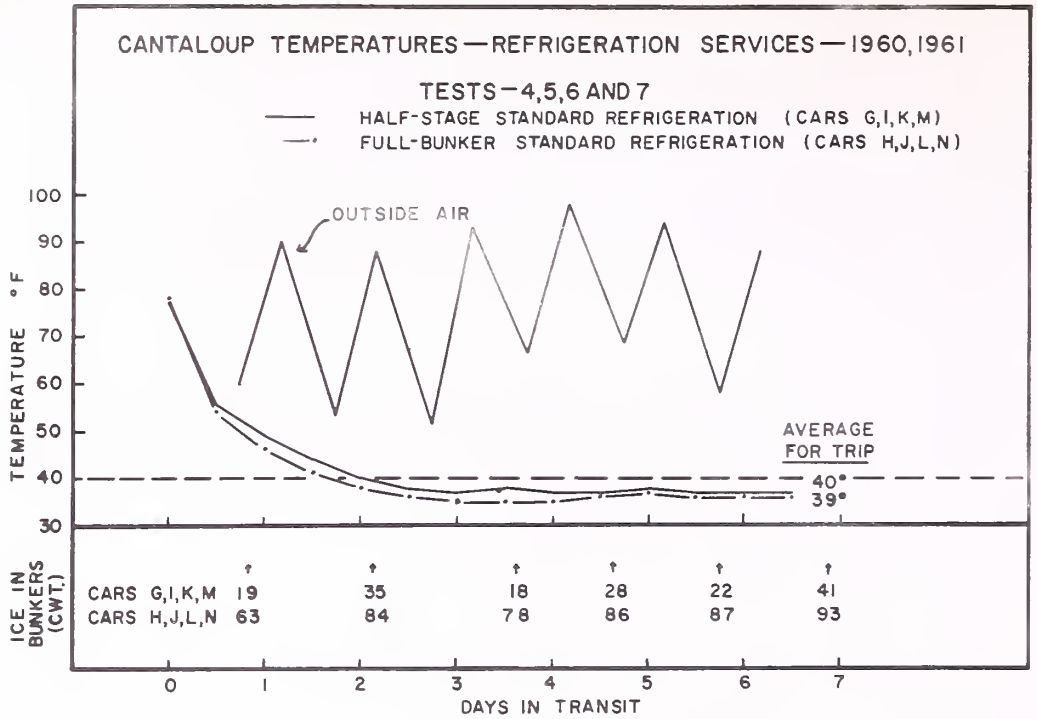

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Figure 2.--Transit temperatures of cantaloups shipped under full-bunker and half-stage Standard Refrigeration from California to eastern markets, 1960 and 1961. Temperatures represent an average of three positions (top, middle, and bottom layers) in four cars for each icing service. Average amounts of ice (in hundreds of pounds) left in the bunkers on arrival at each re-icing station and at destination are also shown.

degrees lower than the middle and bottom layers (fig. 3). Recent tests with cantaloups[6] indicate that 41° is as satisfactory as 36° to 37° for melons held for periods comparable to those for transit to the east coast and 3-day retail period. Therefore, average trip temperatures in all layers of the test cars (38° to 41°) were satisfactory.

The average amount of ice in the bunkers of each of the four half-stage cars at time of loading was about 4,200 pounds (70 percent of half-stage capacity). The average amount of ice remaining in the bunkers of these cars at time of arrival at the first re-icing station (Roseville) was 1,900 pounds (fig. 2). Thus, about 2,300 pounds of bunker ice was melted per car during precooling and transit to Roseville. The theoretical amount of bunker ice that would be melted during this same period of time was calculated by the method used by Pentzer[7] and found to be about 2,500 pounds, which is in close agreement with the actual average ice meltage. These amounts are in addition to the top ice us[illegible]r precooling.

On the ba[illegible]s of these data, half-stage cars should be re-iced with 1,200 to 1,800 pounds of bunke[illegible] ice at the shipping point, when less than 3,000 pounds of ice remain at time of loading. Otherwise, there is a possibility of depleting the ice in the bunkers between the shipping point and the first re-icing station.

One pair of cars (test 8) was delayed 1 day between Roseville, Calif., and Ogden, Utah, because of a derailment; the data from these cars were not included in the above

[6] Personal communication from W. B. McGlasson, University of California, Davis, Calif.
[7] Pentzer W. T., Wiant, James S., and MacGillivray, John H. Market Quality and Condition of California Cantaloups as Influenced by Maturity, Handling, and Precooling. U.S. Dept. Agr. Tech. Bul. 730. 1940 (Out of print.)

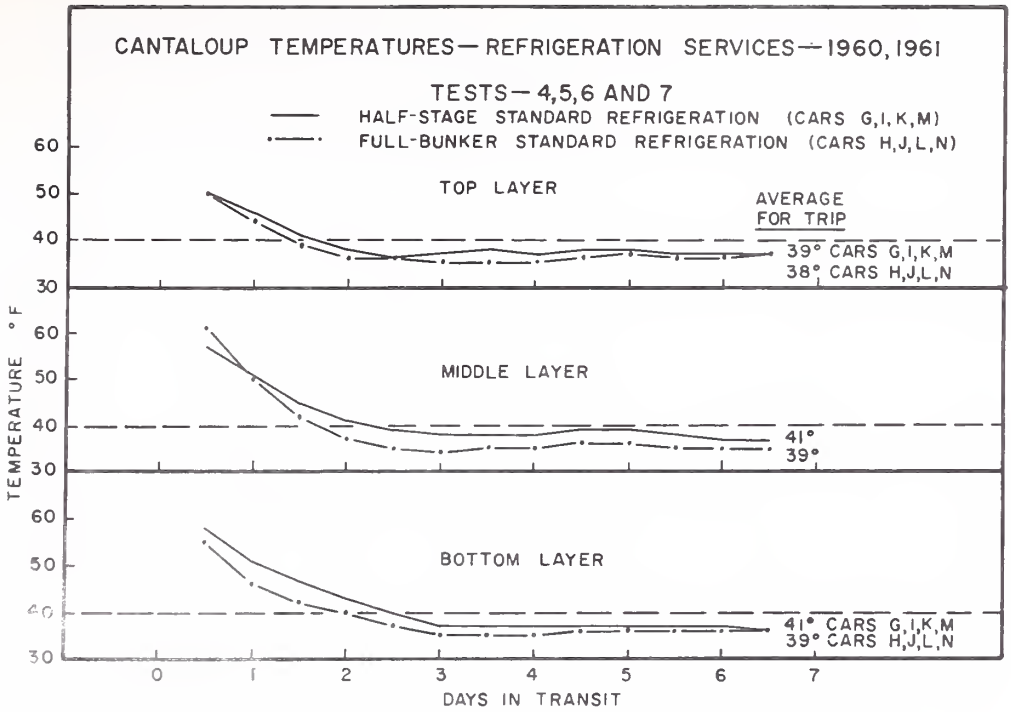

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Figure 3.--Temperatures of cantaloups shipped under full-bunker and half-stage Standard Refrigeration from California to eastern markets, 1960 and 1961. Temperatures represent an average of three (middle layer) or four (top and bottom layers) cars for each icing service.

averages. Since the fans did not operate during the early part of the trip, cooling was delayed and the melons did not reach a desirable transit temperature until late in transit. However, no mold or decay was present in either car on arrival.

Modified vs. Standard Refrigeration.--In 1960 the two cars shipped under rule 254b (cars Q and S) were re-iced on the second and fourth days in transit. As the results were similar in tests 9 (cars Q and R) and 10 (cars S and T), only the transit temperatures for test 10 are shown (figs. 4 and 5). The average trip temperature of the melons in the car shipped under rule 254b was the same (38° F.) as that of melons in the companion car (T) shipped under rule 201 (fig. 4). However, the melons in the car shipped under the modified refrigeration service (rule 254b) were warmer during the last day in transit than those shipped under the conventional service. Although this rise was evident in all layers of the loads, the greatest rise in temperature was in the top layer (fig. 5). Apparently, the ice was very low during the last day, which allowed a slight warming of the melons.

In 1961, the cars shipped under rule 254b (cars U and W) were re-iced at stations normally reached on the second and fifth days in transit, to prevent the rise in temperature during the latter part of the trip. No appreciable warming of the melons occurred during the latter part of the trip in these cars, and the quantity of ice in the bunkers on arrival was satisfactory. Since results in tests 11 and 12 were similar, only the transit temperatures for test 12 are shown (figs. 6 and 7). The average trip temperature of melons in the car shipped under rule 254b (car W) was 2 degrees warmer than that in the companion car (X) shipped under Standard Refrigeration (fig. 6). This slight difference was also apparent among temperatures in the individual layers (fig. 7). This 2- to 3-degree temperature difference was due primarily to large differences in melon temperatures in the two cars at time of loading, rather than to the different refrigeration services.

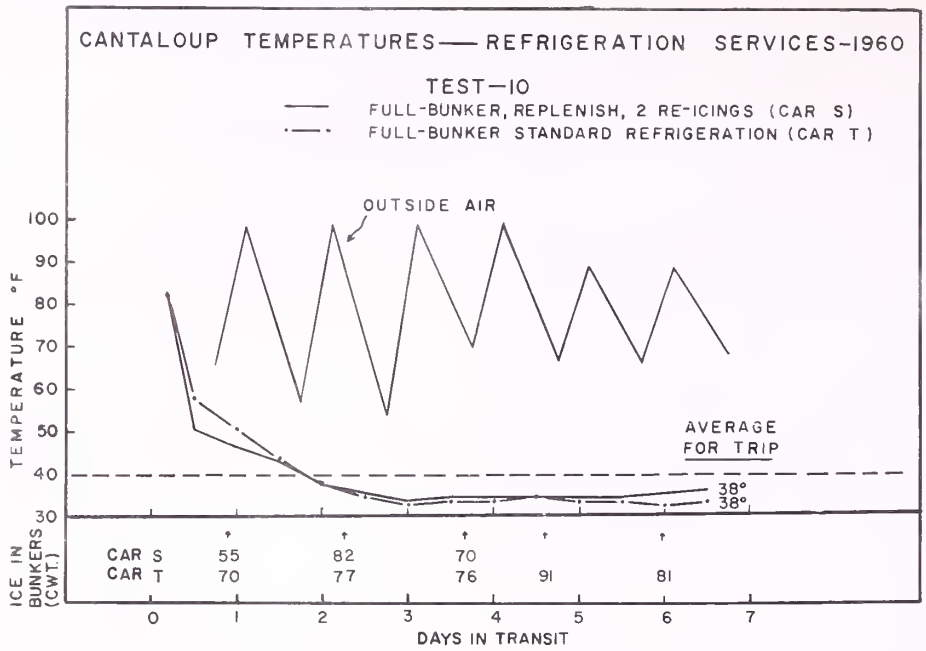

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Figure 4.--Transit temperatures of cantaloups shipped under standard (car T) and modified (car S) refrigeration services from California to New York, 1960. Temperatures represent an average of top, middle, and bottom layers for each service. Quantity of ice (in hundreds of pounds) left in bunkers on arrival at each re-icing station are also shown.

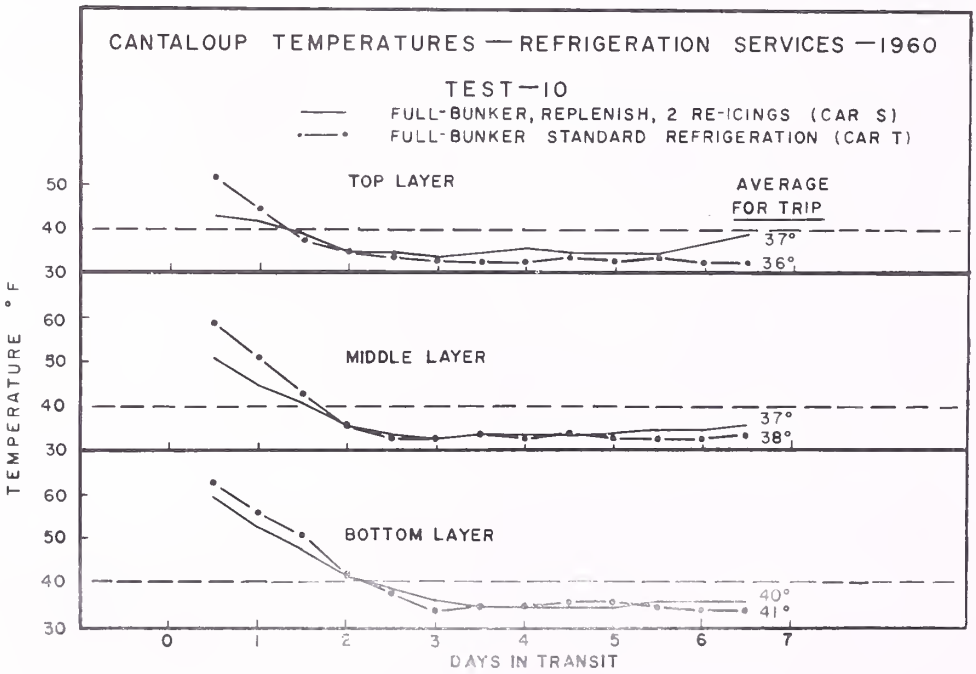

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Figure 5.--Temperatures of cantaloups shipped under standard (car T) and modified (car S) refrigeration services from California to New York, 1960.

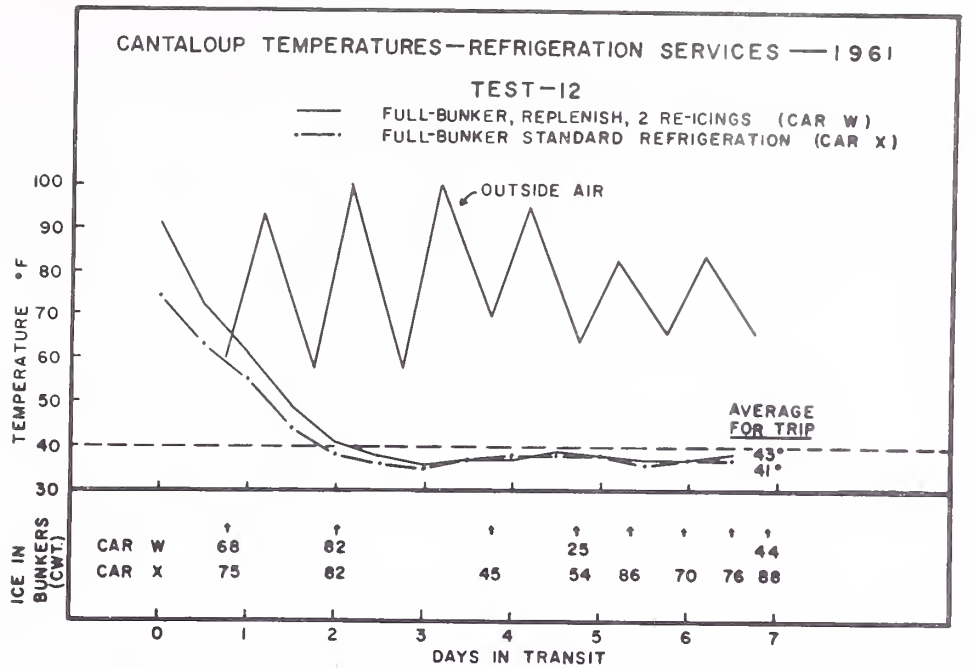

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Figure 6.--Transit temperatures of cantaloups shipped under standard (car X) and modified (car W) refrigeration services from California to New York, 1961. Temperatures represent an average of top, middle, and bottom layers for each service. Quantity of ice (in hundreds of pounds) left in bunkers on arrival at each re-icing station and at destination are also shown.

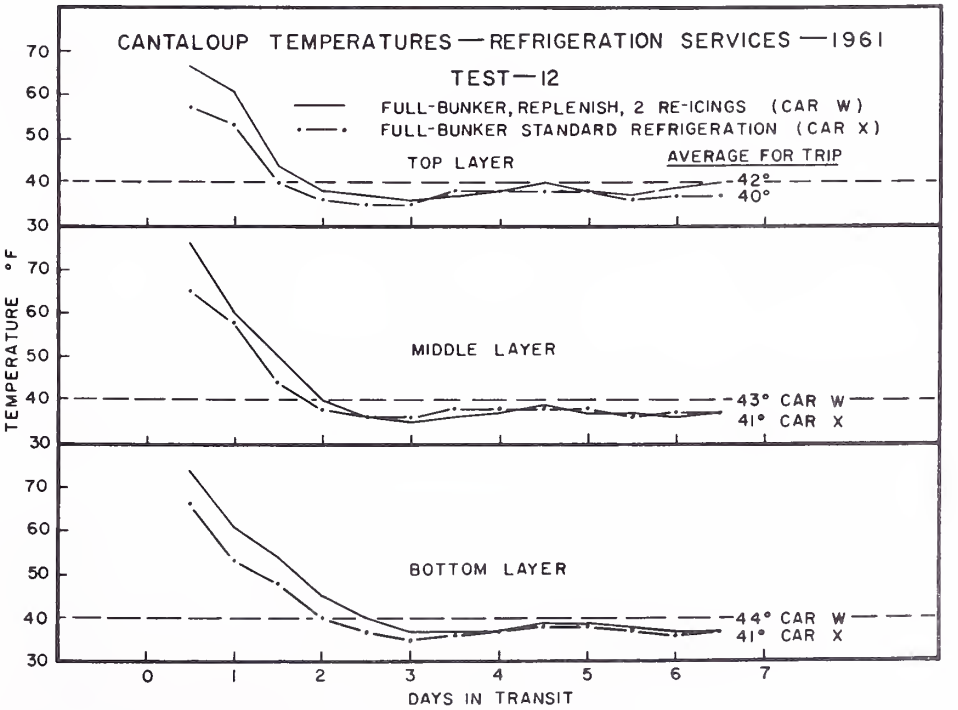

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Figure 7.--Temperatures of cantaloups shipped under standard (car X) and modified (car W) refrigeration services from California to New York, 1961.

The average trip temperature of the melons in the four cars shipped under rule 254b was only 1 degree warmer than that of the companion cars shipped under Standard Refrigeration Service (40° vs. 39° F.). Both refrigeration services cooled melons to 40° in approximately the same period of time, about 2 days.

The cars shipped under the conventional full-bunker Standard Refrigeration in tests 9, 10, and 11 received 2 percent salt at the first and second re-icing stations since this was the procedure normally used by these cooperating shippers. Rule 202 implies that salt is to be added to the bunker ice (table 1). Salt was not used in the companion cars, shipped under rule 254, since the intervals between re-icings were longer and the use of salt might have caused the cars to run out of ice between re-icings.

Cars shipped to Chicago usually arrive on the fifth day. Since re-icing on the second and fifth days is satisfactory for cars shipped to New York, re-icing only on the second day would be satisfactory for cars shipped to Chicago or to other cities of equal transit time from California. Regardless of the destination or the refrigeration service used, cars to be held on track for a period of days before unloading should be examined at time of arrival to determine if re-icing is necessary.

Effect of Refrigeration Service on Quality of Melons

Melon quality, as determined by ratings for general appearance and firmness, was equally satisfactory in both cars of any given test (table 3). The general appearance of all the test melons on arrival was rated "good." After 6 days at 70° F. all were rated "fair" except those in car G, which were rated "fair to good."

TABLE 3.--Market quality of cantaloups shipped from California to the New York market using different refrigeration services, 1960

Test number, car, and refrigeration rule	Shipping point maturity	Time of inspection (days at 70° F.)	General appearance	Firmness	Suture browning		Decay		Incidence of surface mold
					Incidence	Severity	Incidence	Severity	
			Rating[1]	Rating[2]	Percent	Rating[3]	Percent	Rating[3]	Percent
Test 4:									
Car G, rules 201 and 255..	Eastern choice	Arrival	6.9	1.5	7.6	2.2	0	1.0	0
		2 days	7.1	2.0	31.3	2.5	1.0	1.7	0
		4 days	7.0	2.5	[4] 58.7a	2.5	1.1a	1.7	0a
		6 days	6.4	2.8	75.3	3.0	9.4	3.2	0
Car H, rule 201.....	Eastern choice	Arrival	6.8	1.6	12.4	2.7	0	1.0	0
		2 days	6.8	2.3	41.4	2.8	1.0	1.7	1.0
		4 days	6.5	2.7	58.6a	2.8	2.1a	2.3	0a
		6 days	5.4	3.5	76.2	3.4	27.7	2.7	0
Test 5:									
Car I, rules 201 and 255..	Hard ripe	Arrival	6.7	1.5	1.0	1.3	0	1.0	0
		2 days	6.5	2.1	32.3	2.5	0	1.0	0
		4 days	6.2	2.9	73.1a	2.8	3.2a	2.5	2.4a
		6 days	4.7	3.7	85.8	3.0	49.8	2.9	19.4
Car J, rule 201.....	Hard ripe	Arrival	6.7	1.5	1.0	1.7	0	1.0	0
		2 days	6.5	2.0	39.9	2.3	0	1.0	0
		4 days	6.3	2.9	65.6a	2.6	3.2a	2.2	3.2a
		6 days	5.1	3.7	83.2	3.0	41.2	2.9	20.7
Test 9:									
Car Q, rule 254b.....	Eastern choice	Arrival	7.0	2.5	--	--	1.0	1.7	2.9
		2 days	6.7	2.9	--	--	9.0	2.2	12.2a
		4 days	5.9	3.2	41.3a	3.0	15.2a	2.5	--
		6 days	5.2	3.9	66.8	3.3	53.6	2.7	--
Car R, rules 201 and 202..	Eastern choice	Arrival	6.8	2.7	--	--	1.0	1.7	1.9
		2 days	6.7	2.7	--	--	6.8	2.0	13.5a
		4 days	6.6	3.1	29.4a	3.5	10.9a	3.1	--
		6 days	5.4	3.6	50.2	3.3	42.9	3.2	--

See footnotes at end of table.

TABLE 3.--Market quality of cantaloups shipped from California to the New York market using different refrigeration services, 1960--Continued

Test number, car, and refrigeration rule	Shipping point maturity	Time of inspection (days at 70° F.)	General appearance	Firmness	Suture browning		Decay		Incidence of surface mold
					Incidence	Severity	Incidence	Severity	
Test 10:			Rating[1]	Rating[2]	Percent	Rating[3]	Percent	Rating[3]	Percent
Car S, rule 254b.....	Hard ripe	Arrival	6.7	1.6	17.1	2.4	0	1.0	0
		2 days	6.7	2.2	44.4	2.5	0	1.0	2.0
		4 days	6.0	2.8	63.4a	2.9	12.9a	2.8	10.7a
		6 days	5.2	3.4	80.5	3.2	26.3	2.8	23.9
Car T, rules 201 and 202..	Hard ripe	Arrival	6.6	1.9	20.0	2.2	0	1.0	0
		2 days	6.4	2.2	50.5	2.9	2.0	2.3	7.1
		4 days	5.5	2.8	66.0a	3.2	18.7a	3.2	3.3b
		6 days	5.0	3.5	77.0	3.3	41.1	3.0	12.0

[1] Rating scale 1-9: 9 = excellent, 7 = good, 5 = fair, 3 = poor, 1 = inedible.
[2] Rating scale 1-5: 1 = hard, 2 = firm, 3 = fairly firm, 4 = soft, 5 = very soft.
[3] Rating scale 1-5: 1 = none, 2 = trace, 3 = slight, 4 = moderate, 5 = severe.
[4] Underscored data were analyzed statistically. Within a test means (for a given disorder) followed by the same letter are not significantly different; means not followed by the same letter are significantly different at the 1 percent level.

The data on incidence of suture browning, decay, and surface mold after holding for 4 days (after 2 days for surface mold in test 9) at 70° F. were analyzed statistically. The incidence of suture browning and decay was not significantly different in melons from the two cars in any given test. The difference in surface mold was significant in only one test (test 10). In this test more surface mold occurred in melons shipped under the modified service than under Standard Refrigeration Service. Since the average trip temperature was the same in both of these cars (38° F.), the difference in mold must have been due to basic differences in the melons themselves. In general, the quality of melons shipped under modified refrigeration or Standard Refrigeration with half-stage icing (1960 and 1961 tests) was equal to that of melons shipped under full-bunker Standard Refrigeration. These quality ratings reflect the similar trip temperatures of the melons in the two cars in any given test and confirm the results of Ryall and Radspinner[8] who reported that melon quality on arrival was equally satisfactory in half-stage and full-bunker cars shipped under Standard Refrigeration.

DISCUSSION

Freight savings for cars shipped from California to New York or to Chicago are 30 cents per 100 pounds when heavy rather than light loads are used (based on 1962 freight rates). If 10,000 crates of cantaloups were shipped in carlots of 324 crates, the freight cost would be $22,880. The same number of crates shipped in carlots of 432 crates would cost $20,240, a saving of $2,640 or 11.5 percent.

The use of rules 201 and 255 (half-stage Standard Refrigeration) rather than rule 201 (full-bunker Standard Refrigeration) would save $35.19 in refrigeration costs for each car of cantaloups shipped from California to New York. Since Standard Refrigeration under half-stage icing was satisfactory for cars shipped to the east coast, it would be satisfactory for cars shipped shorter distances. The saving would be $29.88 per car for cantaloups shipped from California to Chicago. For each car shipped to New York, the use of modified refrigeration (rule 254) with two re-icings rather than the conventional icing service (rule 201) would save $19.77. For each car shipped to Chicago, the use of rule 254 with one re-icing rather than rule 201 would save $36.50.

[8] See footnote 2.

Modified or half-stage Standard Refrigeration would save an average of about $30 per car, compared to full-bunker Standard Refrigeration. Over 11,000 rail cars of cantaloups were shipped from the San Joaquin Valley of California in 1961. By using the proposed refrigeration services for these cantaloups, about $330,000 in refrigeration costs could be saved each season.

Of the two less expensive refrigeration services tested (rules 201 and 255 and rule 254), rule 254 would be the more practical for the greatest number of shippers for two principal reasons: 1) Each car pre-iced to full-bunker capacity can be shipped either under rule 254 or under the conventional Standard Refrigeration Service (rule 201). The refrigeration service can be chosen after the car is pre-iced and loaded. This is important because many cars are sold after they are pre-iced and loaded, and the buyer usually chooses the refrigeration service to be used. However, cars pre-iced to half-stage capacity can only be shipped under half-stage icing since the ice racks cannot be changed after the car is pre-iced. 2) Under normal conditions, the bunkers of cars pre-iced to full-bunker capacity (rule 254 and rule 201) never need replenishing at the shipping point, as may occasionally be necessary with half-stage cars. The use of half-stage icing would thus necessitate inspection of the bunkers at the shipping point to determine if additional ice were needed; if ice were needed, a small additional expense would be incurred.

When rule 254 is used, the shipper must specify the re-icing stations. Ogden, Utah, is the icing station normally reached on the second day, and Chicago, St. Louis, or Memphis are some of the stations normally reached on the fifth day. When in doubt, the shipper should determine from the carrier the icing stations reached on the second and fifth day by the specific routing to be used.

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